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ANATOMY OF THE APPENDIX
AND APPENDICITIS.

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BY JOSEPH D. BRYANT, M.D.,
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THE anatomic peculiarities of the appendix that affect directly the symptomatology of appendicitis relate especially to the location, direction, and extent of the appendix. The local symptoms are chiefly modified by these characteristics of the organ. The emphatic symptoms belonging to this category may be briefly stated as pain, tenderness, tension, and tumor.

The situation and character of the pain, together with its reflex manifestations, comprise its important elements as modified by the individuality of the diseased appendix causing it. If the pain be dull and throbbing, and be influenced but little, if any, by respiratory movements, the involvement of connective, rather than serous tissue, is indicated. Later in the case, however, the supervention of serious painful phenomena may be slowly or quickly announced.

Appendicitis with primary fibrous-tissue involve-

¹ Abstract of a paper read at the meeting of the N. Y. State Medical Association, February 7, 1894.



ment is necessarily rare, as then the appendix is extra-peritoneal, or is completely environed by inflammatory adhesions, the result of repeated attacks. In but three instances of one hundred and forty-four autopsies made for other than appendicular trouble was the appendix found outside of the peritoneal cavity. In one of these it was above and behind the cecum and colon; in another, behind and near the inner border of the colon, extending even to the liver; and in the third it was behind the colon near the outer border. It is in accordance with the well-known law that the character of pain is modified by the kind of tissue involved, to assume that had either of these appendices been diseased, the primary pain would have been of the connective-tissue type, continuing so until peritoneal involvement had ensued, either by extension of the inflammatory process, or of abscess-rupture. It was my good fortune but a few years ago to meet with a well-pronounced case of this kind in Bellevue Hospital. In this instance, a dull throbbing pain had been present for some time beneath the ascending colon, with tenderness and induration. Suddenly the acute agonizing pain indicative of peritoneal involvement occurred, quickly followed by peritonitis and rapid death. At the time of the consultation I ventured to predict: (1) the presence of a diseased appendix behind the cecum and colon; (2) extensive connective-tissue inflammation and abscess; (3) rupture of the abscess into the peritoneal cavity. The results of the autopsy justified each prediction.

In many cases of recurrent appendicitis the familiar

pain of acute attacks is not present at the outset, and may not appear at all; and, too, respiratory movements cause but little, if any, additional infliction. I saw such a case but a few days ago during recovery from a fourth attack, with intervals of one year each. It is, of course, superfluous to say that primary intra-peritoneal appendicitis causes acute pain, for this is the typical manifestation of the disease. It is proper to add, however, that the mobility and length of the appendix have much to do with the severity and extent of the pain, and also with the rapidity of the diffusion of the poisonous products of the disease. All are aware that the appendices of some are comparatively "free" in the peritoneal cavity, their movements between the contiguous intestines being limited only by their mesenteries, or their attachment to the cecum. The free extremities of such as these are often observed extending upward from between the intestinal loops, and at this time can be aptly compared to the erect position of the deadly cobra when prepared to strike.

Let us now glance for a moment at the records attesting the freedom of movement of intra-peritoneal appendices. In sixty-six examinations, twenty-six (40 per cent.) were "free," in that one-half of the entire length was surrounded by peritoneum. The remaining forty had mesenteries varying from three-fourths to more than an inch in length. Surely the length and the freedom of movement of a diseased intra-peritoneal appendix exercises an important influence on the intensity and area of the pain, and the rapidity of the diffusion of the disease-producing elements. Dr. Reginald Fitz, in his oft-quoted

and classic article, published in the *American Journal of the Medical Sciences*, October, 1886, says: "Sudden severe abdominal pain is the most constant first decided symptom of perforating inflammation of the appendix." As a proof of the fact, he shows that this manifestation occurred in 216 of 257 cases, or 84 per cent. of the number. If we now turn our attention to the percentage of "free" appendices, and those with mesenteries of more than an inch in length, we also find their sum to be 84 per cent. of the entire number. Certainly this similarity of percentages is, at the least, a strange coincidence.

While it is doubtless true that the situation of the pain is regulated to some extent by the location and direction of a diseased appendix, still, neither time nor utility will permit me to indulge in hair-splitting distinctions in this regard, based on the fact of the extension of the appendix outward, downward, inward, etc., as this feature alone possesses no practical importance, except when the appendix extends beyond the usual limit. It may not be amiss to add, in this connection, that the appendix runs inward in about 25 per cent.; that it is curled behind the cecum in about 20 per cent., and that it extends into the pelvis in 14 per cent. of all cases. The average length (post-mortem) of the appendix in the male is $3\frac{1}{2}$, and in the female $3\frac{1}{10}$ inches, as deduced from 144 examinations. The importance of the frequency (14 per cent.) of intra-pelvic extension should not be considered lightly. Nor can the differences in the length of the organ, as between the sexes, be deemed insignificant, when it is noted that the half-inch difference between them causes the appendix

of the male to enter the pelvis twice as often as that of the female. The clinical importance of intra-pelvic extension of the appendix cannot be gainsaid. In a diseased appendix there located the pain may be nearer the hypogastrium, and, too, it may involve the pelvic peritoneum, and modify the action of the pelvic viscera during functional activity. And especially are these facts true if the extremity of the appendix be the portion involved by gangrene or perforation.

Thus far only direct pain has been considered, of both the acute and dull types. Reflex pains, while less important than the direct, are, nevertheless, of great diagnostic significance. Frequently during the course of an attack, and especially at the outset, reflected pain may be present in almost any part of the abdomen. And, too, it is observed not infrequently in the testicle, perineum, rectum, thigh, lumbar region, etc. In fact, referred or reflex pains may occur in the distribution of any spinal nerve directly involved by the disease. Fitz has shown that in 213 cases of appendicitis pain was present in the right iliac fossa in 48 per cent.; in the abdomen in 36; in the hypogastrium in 5; in the umbilical region in 4; in the epigastrium in 2; and 1 per cent. each in the stomach, hepatic region, left iliac fossa, and right hip and groin. I myself treated a case on June 23, 1886, in which the pain was referred to the umbilical region only. That this was a genuine case cannot be gainsaid, as the appendix was found to be perforated and was removed. The anatomic reason for the occurrence of these reflex pains resides in the well-known influence exercised

by the abdominal sympathetic ganglion on the contents of the belly. A misplaced appendix, or a wandering cecum, will account for an unusual pain-site in a few instances. Without amplification, it is sufficient to say now that pain in the right testicle, with or without its retraction, indicates the direct involvement of the genito-crural nerve. The same may be said also of the ilio-inguinal, and the anterior crural, when pain is referred to their respective distributions, in connection with recognized or suspected appendicitis.

Tenderness, the second of the inherent manifestations of appendicitis, may be either local or general, superficial or deep, keen or dull, depending on the extent, location, and character of the inflammation and the variety of the tissue involved by it. If the extra-peritoneal connective tissue be first involved, as when the appendix is located behind the colon, or behind a cecum not surrounded by peritoneum, or outside the peritoneum elsewhere, and, perhaps, between the layers of the broad mesentery of the appendix, the tenderness at the outset is local, deep-seated, and dull. That such cases as these are rare is obvious, on account of the great infrequency of appendices so placed. Quickly, however, the dull tenderness is supplemented and obscured by the acute variety, due to the rapid extension of inflammation to the contiguous peritoneum. The rapidity of the supervention of the acute pain is in direct proportion to the gravity of the lesion and the amount of connective tissue involved by it. Dull tenderness of much duration is indicative, therefore, of a post-colon

position of the appendix, and especially is this true in the absence of a meso-colon, which, according to Treves, happened in 52 per cent. of the subjects examined by him.

Acute tenderness is, of course, strong proof of the involvement of the peritoneum, and when it is circumscribed and marks the outset of the attack, its location may be accepted as indicating the site of the initial lesion. If this statement be true, then, indeed, no definite point of tenderness can be established that may be regarded as diagnostic of this disease. The varying directions of the appendix already cited; the differences in its length, and in the situation in it of the point of greatest disease; together with the doubt as to the location of the cecum from which it arises, all conspire to make the establishment of such a point impossible, and a reliance on it impracticable and misleading. Of general tenderness I will say but little, as it cannot be regarded as indicative of a circumscribed process, and is, therefore, not to be considered as of much practical bearing on the arrangement of the appendix. It is proper, I think, to say that in those cases of appendicitis observed by me, in which the diseased appendix was "free," the area of tenderness was far greater than in those not so freely movable.

The term tension refers mainly to tension of the abdominal walls—a tension that may be limited to the side of the attack, or be more or less general, according to the extent of the inflammation associated with it. The presence of this tension-phenomenon is of beneficent significance and should

incite the profoundest respect of the most skeptical minds. The motor nerve-fibers that animate the abdominal muscles are from the lower intercostals, and are intimately connected with the sympathetic supplying the abdominal viscera, through the lower thoracic ganglia from which the splanchnic nerves are derived. As a result of this arrangement, in acute peritonitis the muscles of the abdomen become quickly and firmly contracted, and thus shield the underlying viscera from external force and keep them as quiet as it is possible to do by physical means alone. Tension of the right rectus abdominis muscle in appendicitis is an early and important symptom and indicates the presence of limited peritonitis, and fulfils the conservative purposes already stated. And for these reasons the left rectus goes on guard too, when its subjacent viscera are similarly involved. Muscular tension in this disease is not limited entirely to the abdominal walls, as the psoas and iliacus muscles also contract from nervous involvement or direct implication, causing flexion of the thigh. The bladder and rectum often become fretful, especially if the diseased appendix extends into the pelvis or is attached to the peritoneum at its brim. The cremaster muscle exercises its prerogative on the testicle, if the genito-crural nerve is implicated.

Tumor is a symptom of dual importance on account of its diagnostic and therapeutic significance. The former attribute alone concerns the subject of this paper. That the situation and extent of the diseased appendix has much to do with the location and the determination of the

presence of tumor cannot be denied. Generally speaking, the location of the tumor indicates the situation of the lesion, and it is especially significant if the tumor be small, firm, deep-seated, and fixed in its position. If, on the other hand, it be large, not firm, superficial, and movable, its bearing on the site of the initial disease is of a general character only. When present, according to Fitz, tumor is detected by palpation from the first to the eighth day of the attack, inclusive. In 24 cases it appeared—in 1 on the first day; in 3 on the second; in 4 on the third; in 2 on the fourth; in 4 on the fifth; in 5 on the sixth; in 4 on the seventh; and in 1 on the eighth day. The third, fifth, and sixth days are noticed to be the most prolific ones. Tumor may be early present and yet not be detected till later in the disease, owing to its obscure position, as when associated with a diseased appendix that is located behind the cecum (22 per cent.); when placed behind the colon (2 per cent.); when extended into the pelvis of the intra-pelvic portion to the diseased part (14 per cent.); with a tympanitic cecum, and with general tympanites irrespective of its location. In the intra-pelvic cases tumor may often be detected in the pelvis and not elsewhere, by rectal or vaginal examination. Still, in these cases, tumor may escape the vigilance of the closest scrutiny.

Owing to time-limit I have dwelt only on the leading cardinal symptoms, leaving consideration of the rarer and more curious manifestations for another occasion. In closing, permit me to submit the following conclusions for your consideration :

1. That the location, direction, and extent of the appendix have an important bearing on the clinical history of appendicitis.

2. That the well-recognized variations of the appendix in length, direction, and location, and the varying site of the cecum, and of the seat of the disease of the appendix, make the establishment of a definitely-seated diagnostic point of tenderness unwise and misleading.

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